I CLAIM:

1. An automatic gain control ("AGC") for providing automatic gain control of an signal comprising:

a power estimator for receiving the signal and providing an estimated power of the signal;

a gain lookup table comprising a plurality of gain values, the gain lookup table capable of providing a gain level in accordance with the estimated power of the signal; and

a multiplier in communication with said gain lookup table for multiplying the signal with the gain level to provide an output signal with automatic gain control.

2. The AGC of claim 1 wherein said power estimator comprises a single pole filter to estimate the power of the signal.

3. The AGC of claim 1 wherein said estimated power of the signal forms an index to access the gain lookup table.

4. The AGC of claim 3 wherein the index $q(t)$ to access the gain lookup table is formed by a function comprising:

$$q(t) = \left(\frac{TABLE\_SIZE - 1}{THSAT - THQUIET - 1} \right) (P_{in}(t) - THQUIET)$$

wherein *TABLE_SIZE* comprises a number of entries in the gain; *THSAT* and THQUIET comprise threshold levels.

5. The AGC of claim 1 wherein the gain lookup table comprises a computer data structure stored in memory.

6. The AGC of claim 5 wherein the computer data structure comprises an array of gain values.

7. The AGC of claim 1 wherein the gain lookup table comprises gain values according to the function:

$$g(t) = GHI \exp(-b(P_{in}(t) - THQUIET))$$

$$b = \frac{\log GHI - \log GSAT}{THSAT - THQUIET}$$

5   wherein $g(t)$ comprises the gain value, $P_{in}(t)I$ is an input power level, GHI, $GSAT$ are fixed gain levels, and $THSAT$, $THQUIET$ comprise threshold levels.

8. The AGC of claim 1 wherein the gain lookup table comprises a first threshold level wherein the provided gain level is a first constant level when the estimated power of the signal is 10   below the first threshold level.

9. The AGC of claim 8 wherein the first threshold level is a noise level.

10. The AGC of claim 1 wherein the gain lookup table comprises a second threshold 15   level wherein the gain level is a second constant level when the estimated power of the signal is above the second threshold level.

11. The AGC of claim 10 wherein the second threshold level is a saturation level.

20   12. The AGC of claim 1 wherein only a portion of the gain lookup table is stored in memory.

13. A method of providing an automatic gain control to a signal to form an automatic gain controlled signal comprising the steps of:
25   estimating the power of the signal;
generating a gain value in accordance with the power of the signal; and
applying the gain value to the signal to form the automatic gain control signal.

- 16 -

14. The method of claim 13 wherein the step of estimating the power of the signal comprises applying a single pole filter.

5   15. The method of claim 14 wherein the single pole filter is of a form comprising:

$$P_{in}(t + 1) = (1 - \alpha) P_{in}(t) + \alpha|ne_{in}(t)|$$

wherein

$$0 < \alpha < 1;$$

t comprises a time variable;

10   P_{in} comprises an input power level;

ne_{in} comprises a input signal level; and

α comprises a time constant.

16. The method of claim 13 wherein the step of applying the gain value comprises
15   multiplying the signal by the gain value to form an automatic gain controlled signal.

17. The method of claim 13 wherein the step of generating a gain value further comprises the step of:

forming an address to access the gain lookup table as a function of the power of the
20   signal.

18. The method of claim 17 wherein the step of forming an address $q(t)$ comprises a function:

$$q(t) = \left(\frac{TABLE\_SIZE - 1}{THSAT - THQUIET - 1} \right)(P_{in}(t) - THQUIET)$$

25   wherein *TABLE_SIZE* comprises a number of entries in the gain;

$P_{in}(t)$ comprises the estimated power of the signal; and

THSAT and THQUIET comprise threshold levels.

- 17 -

19. The method of claim 13 wherein the step of generating a gain value further comprises the step of:

accessing a gain lookup table comprising a plurality of gain values.

5   20. The method of claim 13 further comprising the steps of:

comparing the power of the signal to a first threshold value; and

setting the gain value to a first gain level if the power of the signal is less than the first threshold level.

10   21. The method of claim 13 further comprising the steps of:

comparing the power of the signal to a second threshold value; and

setting the gain value to a second gain level if the power of the signal is greater than the second threshold level.

15   22. The method of claim 13 wherein the step of generating a gain value is in accordance with a function comprising:

$$g(t) = GHI \exp(-b(P_{in}(t) - THQUIET))$$

$$b = \frac{\log GHI - \log GSAT}{THSAT - THQUIET}$$

wherein $g(t)$ comprises the gain value, GHI, $GSAT$ are fixed gain levels, and $THSAT$, $THQUIET$ are threshold levels.

20

23.   An automatic gain control ("AGC") for providing automatic gain control with an adaptive gain level comprising:

an automatic gain control circuit to provide an automatic gain controlled output signal;

an output power block for providing the output power of the automatic gain controlled output signal;

25   output signal;

an adder for determining an error signal in accordance with the output power of the automatic gain controlled output signal; and

- 18 -

a gain lookup table for storing gain values, wherein the gain table is adapted in accordance with the error signal.

24. The AGC of claim 23 wherein the automatic gain control is adapted to compensate for non-linearity in a microphone/codec.

25. The AGC of claim 23 wherein the output power block estimates the output power according to a single pole filter.

26. The AGC of claim 23 wherein the adder determines the error signal with respect to a set-point reference signal.

27. The AGC of claim 28 wherein the adder determines the error signal as the difference between the output power of the automatic gain controlled output signal and the set-point reference signal.

28. The AGC of claim 29 wherein the gain table is adapted with a new gain value, $G_{new}(q)$; wherein $G_{new}(q)$ is computed in accordance with the scaled output signal $P_{out}(t)$ comprising the following function:

$$G_{new}(q) = G_{old}(q) + \text{ß}(\text{set-point} - P_{out}(t));$$

wherein ß is a scaling factor $0 < \text{ß} < 1$, the set-point is a desired reference level, $P_{out}(t)$ comprises the output power of the automatic gain controlled output signal, and $G_{old}(q)$ comprises a gain table value.

29. The AGC of claim 23 further comprising a multiplier for scaling the error signal to provide a scaled output signal.

30. The AGC of claim 23 further comprising an absolute value circuit for determining the absolute value of the automatic gain controlled output signal.

31. The AGC of claim 23 wherein the automatic gain control is dynamically adapted to compensate for non-linearity in a microphone/codec as the AGC operates.

32. The AGC of claim 23 wherein the automatic gain control circuit comprises a closed-loop AGC.

33. A method of providing an automatic gain control system comprising a gain lookup table with an adaptive gain level comprising the steps of:

   providing an automatic gain controlled output;

   estimating an output power of the automatic gain control system;

   calculating an error signal in accordance with the output power of the automatic gain control system; and

   adapting the gain lookup table in accordance with the error signal.

34. The method of claim 33 wherein the output power is estimated using a single pole filter.

35. The method of claim 33 wherein the step of calculating the error signal calculates the error signal as a difference of the output power signal and a reference signal.

36. The method of claim 33 wherein the wherein the step of adapting further comprises the steps:

   scaling the error signal by a factor to calculate a scaled error signal; and

   updating the gain table with the scaled error signal.

37. The method of claim 33 wherein the step of adapting adapts the gain lookup table with $G_{new}(q)$; wherein $G_{new}(q)$ is computed in accordance with the scaled output signal $P_{out}(t)$ comprising the following function:

$$G_{new}(q) = G_{old}(q) + \beta(\text{set-point} - P_{out}(t));$$

wherein ß is a scaling factor $0 < ß < 1$, the set-point is a desired reference level, $P_{out}(t)$ comprises the output power of the automatic gain controlled output signal, and $G_{old}(q)$ comprises a gain table value.

38. The method of claim 33 wherein the gain lookup table of the automatic gain control system is adapted to compensate for the non-linearity of a microphone/codec.

39. The method of claim 33 wherein the step of estimating the output power is estimated with a single pole filter comprising:

$$P_{in}(t+1) = (1-\alpha)\,P_{in}(t) + \alpha|ne_{in}(t)|$$

wherein

$0 < \alpha < 1$;

t comprises a time variable;

P_{in} comprises an input power level;

ne_{in} comprises a input signal level; and

α comprises a time constant.

40. The method of claim 33 wherein the step of adapting adapts the gain lookup table dynamically.

- 21 -